TITLE OF THE INVENTION: VEHICLE LOADING AND UNLOADING SYSTEM

## CROSS-REFERENCE DATA

The present application is a continuation-in-part of United States patent application No. 09/501,524 filed on February 9, 2000, and allowed on October 24, 2001.

## FIELD OF THE INVENTION

The present invention relates to a vehicle loading and unloading system, and more particularly to a system including an automated forklift carriage used for loading and unloading articles into and from transport trucks.

## BACKGROUND OF THE INVENTION

United States patent No. 4,439,093 issued in 1984 to R.W. Victorino discloses a system for handling palletized articles. This system includes *inter alia* the step of loading the palletized articles into a conventional semi-trailer truck with a conventional forklift truck, as known in the art. However, it becomes difficult to efficiently load a semi-trailer truck with palletized articles, without unnecessarily losing space inside the truck, and at an efficient speed, without the forklift truck driver accidentally hitting the semi-trailer truck walls with the articles while loading them, considering the often small lateral clearance between the forklift truck loaded with articles and the semi-trailer lateral walls.

Some automated truck loading systems have been developed, such as the one shown in United States patent No. 4,171,178 issued in 1979 to R. Birkenfeld *et al.* In this patent, a rail-guided carriage is shown to be used to load a truck from its lateral sides. The rail-guided carriage has the disadvantage of requiring a flawless alignment of the truck relative to the loading dock for loading the articles into the truck in a space-efficient manner. Indeed, should the truck be positioned in a non-parallel relationship with the carriage rails, then the articles will be positioned in a non-parallel fashion relative to the truck walls, and economically valuable space

will be wasted inside the semi-trailer. Also, the Birkenfeld patent shows a truck being loaded sidewardly, but it is understood that it is more complex and it requires more precision for a carriage to be aligned relative to the rear opening of a conventional rearwardly-opened semi-trailer truck such as the one shown in the above-mentioned Victorino patent, than it is for a carriage to be aligned with the often wider side openings of laterally loaded trucks such as the one shown in the Birkenfeld patent. Also, conventional merchandise semi-trailers are more often provided with a rear opening, so the Birkenfeld system is not representative of the most likely type of truck encountered.

## SUMMARY OF THE INVENTION

The present invention relates to a carriage for carrying articles, said carriage defining a longitudinal axis and comprising a frame movable over ground in a direction parallel to said longitudinal axis, a powered driving device mounted to said frame for selectively driving said carriage along said longitudinal axis, a powered article-carrying device mounted to said frame for releasably carrying articles on said carriage, guide members laterally protruding beyond said frame on both said carriage sides for engagement of said guide members against objects outboard of said carriage for allowing self-alignment of said carriage with respect to the objects when said carriage is moving along said longitudinal axis, and a linkage pivotally attached to said frame and carrying said guide members, said guide members forced by said linkage into an integral common displacement relative to said frame so as to remain symmetrically disposed relative to said frame at all times, said guide members being movable relative to said frame between an inner limit position toward said frame and an outer limit position away from said frame, said carriage also comprising a biasing member mounted to said frame and continuously biasing said guide members through the instrumentality of said linkage towards said outer limit position.

The present invention also relates to a system for selectively moving articles into and out of a number of loading areas, said system having mutually transverse longitudinal and

lateral axes defining longitudinal and lateral directions, respectively, said system comprising a carriage movable along variable longitudinal distances in said longitudinal direction, said carriage having full longitudinal movement capability throughout said loading areas and being capable of depositing and retrieving an article at any point in said longitudinal direction, said carriage being movable also along a continuous range of variable lateral distances in said lateral direction, said variable lateral distances being determined by an article having any lateral position along said continuous range of lateral distances, wherein said carriage can selectively engage and release the article at a predetermined lateral position.

Preferably, the system further comprises a movable bogie, said bogie being capable of moving said carriage in said lateral direction.

Preferably, said bogie is guided by at least one rail along said lateral direction.

Preferably, at least one of said carriage and the article is indexed to a predetermined lateral position.

Preferably, said longitudinal and lateral axes define a horizontal plane.

Preferably, said longitudinal and lateral axes are perpendicular.

Preferably, said system further comprises a conveyor for transporting the article, with said conveyor being located in a plane vertically spaced from said horizontal plane defined by said longitudinal and lateral axes of said system.

Preferably, said number of loading areas define longitudinal dimensions of equal value.

Preferably, said conveyor is parallel to said lateral axis.

Preferably, said conveyor is elevated relative to said horizontal plane defined by said longitudinal and lateral axes.

The present invention also relates to a method for selectively moving articles into and out of a number of loading areas with a system having mutually transverse longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said system comprising a carriage, said method comprising the steps of moving said carriage along variable longitudinal

distances in said longitudinal direction, with said carriage having full longitudinal movement capability throughout said loading areas, depositing or retrieving an article at any point is said longitudinal direction with said carriage, and moving said carriage along variable lateral distances in said lateral direction when said carriage is not moving in said longitudinal direction, said variable lateral distances being determined by an article having a lateral position, wherein said carriage can selectively engage and release the article at predetermined lateral positions.

The invention further relates to a method for loading an article from an initial position at any point into a loading area with a system having mutually transverse longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said system comprising a carriage comprising a powered article-carrying device, said method comprising the steps of:

- moving said carriage along said lateral direction to a carriage lateral position laterally aligned with said article initial position;
- moving said carriage along said longitudinal direction to a carriage longitudinal position determined by said article initial position;
- retrieving the article with said article-carrying device;
- moving said carriage along said longitudinal direction towards said loading area; and
- depositing the article in said loading area with said article-carrying device, at any longitudinal point within said loading area.

The invention further relates to a method for unloading an article from an initial position at any point in a loading area to a final position, with a system having mutually transverse longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said system comprising a carriage comprising a powered article-carrying device, said method comprising the steps of:

- moving said carriage along said lateral direction to a carriage lateral position laterally aligned with said article initial position;
- moving said carriage along said longitudinal direction toward said loading area to a carriage longitudinal position determined by said article initial position;

- retrieving the article with said article-carrying device;
- moving said carriage along said longitudinal direction away from said loading area; and
- depositing the article in said final position with said article-carrying device.

The invention further relates to a method for moving an article from an initial position to a final position, with a selected one of said initial and final positions being within a loading area having an estimated position and a real position which may be laterally offset relative to said estimated position, with a system having mutually transverse longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said system comprising a carriage comprising a powered article-carrying device and a bogie capable of carrying said carriage and having a pair of pivotable gates defining outer free ends, said method comprising the steps of:

a) moving said bogie carrying said carriage along said lateral direction to a carriage lateral position longitudinally aligned with said loading area estimated position;

b) opening said bogie gates until at least one of said gates abuts against a reaction surface corresponding to said loading area real position;

c) rectifying the position of said bogie along said lateral direction according to the respective angular positions of said gates, for longitudinally aligning said bogie with said loading area real position;

d) moving said carriage along said longitudinal direction towards said article initial position to a carriage longitudinal position determined by said article initial position;

e) retrieving the article with said article-carrying device;

f) moving said carriage along said longitudinal direction towards said article final position to a carriage longitudinal position determined by said article final position; and

g) depositing the article in said final position with said article-carrying device.

Preferably, in step (b) said bogie gates are opened until both said gates abut against respective reaction surfaces corresponding to said loading area real position.

The invention further relates to an alignment mechanism for use with a carriage

selectively movable along mutually transverse longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said alignment mechanism comprising a pair of arms, each said arm being biased transversely relative to said longitudinal axis and outwardly from said carriage, wherein said arms may engage an object outboard of said carriage as said carriage moves along said longitudinal axis for self-alignment of said carriage along said longitudinal axis.

Preferably, said arms each have an outer free end carrying a guide member destined to engage an object outboard of said carriage.

Preferably, each said guide member is a guide wheel rotatable about a vertical axis.

Preferably, each said arm is articulably outwardly biased.

Preferably, each said arm is articulably linked to the other said arm to form a linkage for pivotal attachment thereof to said carriage.

Preferably, said guide members are forced by said linkage into an integral common displacement for remaining symmetrically disposed relative to said carriage at all times, said guide members being movable between an inner limit position and an outer limit position, said alignment mechanism further comprising a biasing member mounted to said frame and continuously biasing said guide members through the instrumentality of said linkage towards said outer limit position.

The invention further relates to an automated system for selectively moving articles into and out of a number of loading areas, said system having mutually transverse longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said system comprising a carriage autonomously movable along variable longitudinal distances in said longitudinal direction, said carriage having full longitudinal movement capability in said loading areas and being capable of depositing or retrieving an article at any point is said longitudinal direction, said carriage being movable also along variable lateral distances in said lateral direction, said variable lateral distances being determined by an article having a lateral position,

wherein said carriage can selectively engage and release the article at a predetermined lateral position.

The invention further relates to a system for selectively loading articles into and unloading articles from a number of loading areas, said system having mutually transverse longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said system comprising:

- an automated carriage movable along variable longitudinal distances in said longitudinal direction, said carriage having full longitudinal movement capability in said loading areas and being capable of depositing or retrieving an article at any point is said longitudinal direction, said carriage being movable also along variable lateral distances in said lateral direction, said variable lateral distances being determined by an article having a lateral position, whereby said carriage can selectively engage and release the article at a predetermined lateral position; and
- an automated article handling assembly capable of moving the articles towards and away from said carriage;

wherein said automated carriage and said automated article handling assembly have independent movement capability.

Preferably, said automated carriage and said automated article handling assembly further have simultaneous movement capability.

Preferably, said system further comprises at least one additional carriage similar to the first-named carriage.

The invention further relates to a system for selectively moving articles into and out of a number of loading areas, said system having mutually transverse longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said system comprising a carriage movable along variable longitudinal distances in said longitudinal direction, said carriage being longitudinally movable along said loading areas and being capable of depositing and retrieving an article at any point in said longitudinal direction, said system further comprising a bogie movable along variable lateral distances in said lateral direction, said variable lateral distances

being determined by an article having a lateral position, said bogie being provided with a pair of gates pivotable between a closed position and an opened position for abutment of said gates against outboard surfaces corresponding to a said loading area in their said opened position, said system also comprising indexing means capable of rectifying the position of said bogie according to the respective angular positions of said bogie gates and capable of rectifying the position of the article relative to said bogie, wherein said carriage is carried by said bogie along said lateral direction and can move out of said bogie along said longitudinal direction, and wherein said carriage can selectively engage and release the article at a predetermined lateral position.

## DESCRIPTION OF THE DRAWINGS

In the annexed drawings:

Figure 1 is a perspective view of a loading dock, with the adjacent wall being broken away for showing the inner components of the loading station registering with the loading dock, figure 1 further showing the rear portion of a semi-trailer positioned so as to register with the loading dock and loading station, and the carriage-carrying bogie moving towards the loading station;

Figure 2 is a perspective view similar to figure 1, although at a slightly different angle, wherein the carriage-carrying bogie is aligned with the loading station, wherein the pivotable alignment gates are in a partly opened position and wherein palletized articles to be loaded into the semi-trailer are located on the overhead conveyor of the truck loading station;

Figures 3 to 6 are side elevations of the elements shown in figure 2, sequentially illustrating the steps of the articles being loaded into the semi-trailer;

Figure 7 is a perspective view of the carriage-carrying bogie of the invention, with the pivotable gates being shown in an opened condition;

Figures 8 and 9 are respectively a perspective view and a top plan view of the automated carriage of the invention;

Figure 10 is a perspective view of the frame structure and of the spring-loaded

alignment linkage of the carriage of the invention; and

Figure 11 is a top plan view of the spring-loaded alignment linkage of the carriage according to the invention.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

Figure 1 shows a loading station 20 including a loading dock 22 defined by an opening 24 in a wall of a building and a floor portion 26 which is substantially at a same height as the flooring 28 of a semi-trailer 30 which registers with loading station 20. As known in the art, a pivotable panel 32 hingedly attached to dock floor 26 bridges the dock floor 26 and the semi-trailer floor 28 and acts as a ramp to compensate any vertical offset between dock floor 26 and semi-trailer floor 28.

In the description hereinafter, reference will be made to the loading of articles into semi-trailer 30, although it is understood that the unloading of articles therefrom could be accomplished by reversing the steps accomplished to load the semi-trailer 30. Also, although a semi-trailer conventionally used with a truck is shown, it is understood that loading and unloading of articles with the system according to the present invention could be accomplished onto other vehicles or machinery having a similar structure as the semi-trailer 30, into respective loading areas.

Figures 1 and 2 show that loading station 20 further includes an overhead conveyor 34 of conventional construction, which is destined to convey palletized articles 36 to loading station 20, i.e. in general register with dock 22, as will be detailed hereinafter. Conveyor 34 runs parallel to dock opening 24 and vertically clears same by the support of spaced-apart upright posts 39 which horizontally clear opening 24. Palletized articles 36 include two pallets 37a supporting boxed goods 37b.

A set of three rails 38 are fixedly installed on the floor parallel to the dock opening 24, so as to carry a bogie 40 movable along rails 38 between loading station 20 and other similar loading stations (not shown). Rails 38 run parallel to conveyor 34, and thus bogie 40 is

movable parallel to and along conveyor 34, as suggested in figure 1. To load articles 36 into semi-trailer 30, bogie 40 is initally automatically positioned in centered register with dock opening 24, as shown in figure 2. Also, conveyor 34 moves to align articles 36 with bogie 40, and thus articles 36 and bogie 40 are always symmetrically aligned relative to each other through electronic control devices (not shown).

Bogie 40 is shown in figure 7, and includes a rigid, flat platform 42 and a rearwardly positioned control panel 44 which allows the controller to selectively move bogie 40 along rails 38 and which further allows the controller to selectively pivot frontwardly located alignment gates 46, 48 between a closed condition (shown in figure 1), through an intermediate partly opened condition (shown in figure 2) into an opened condition (shown in figures 3-7). In their opened condition, gates 46, 48 become coextensive with fixed lateral railings 50, 52 provided on each side of bogie 40, to form elongated alignment gate members preferably having substantially flat inner surfaces. The gates 46, 48 are sized to extend with their outer free end portions slightly beyond dock opening 24 when they are extracted, so as to be engageable with their outer free tips 46a, 48a against the lateral inner walls of the truck semi-trailer 30 and become co-extensive and substantially collinear with the railings 50, 52.

As shown in figure 7, hydraulic rams 54, 56 are used to control the pivotal displacement of gates 46, 48.

A forklift carriage 58 is provided on bogie 40, as shown in figures 1-6 and 8-11. Carriage 58 is movable over ground, and more particularly carriage 58 comprises a frame structure 60 supported over ground by a number of front and rear support wheels 62 and 64 respectively, with front support wheels 62 being larger since they will support the main load of palletized articles 36 when temporarily transported by carriage 58, as described hereinafter. Frame 60 has a number of perpendicularly arranged bars 66 to form a rigid structure, including a frontmost bar 66a supporting a forklift structure 68 and lateral bars 66b, 66c (figures 9-10).

Forklift structure 68 includes a vertically disposed track member 70 fixedly attached to frontmost bar 66a of frame 60, along which a fork member 72, e.g. including four

forks 72a as shown in the drawings, is vertically movable under the selectively activated bias of an actuation member in the form of a hydraulic cylinder (not shown). The fork member 72 and track member 70 assembly is of known construction, and is actuated by know means. Frame 60 further supports a casing 74 enclosing the motor elements of carriage 58, and a hydraulic fluid reservoir 76 for feeding the hydraulic cylinder allowing the vertical movement of fork member 72. A wire 78 power feeds the carriage motor, wire 78 being linked to the bogie control panel 44 as shown in figures 3-6. Figures 8-9 further show that a spring-loaded rotatable spool 80 is provided at the rear end portion of carriage 58, on frame 60, with the wire 78 being wound around spool 80 so that wire 78 remain tensioned over ground between carriage 58 and control panel 44 while being long enough to be unrolled and allow movement of carriage 58 away from and back towards control panel 44. A carriage control panel 81 is carried at the rear end of from 60.

Carriage 58 is further provided with a spring-loaded linkage 82 which is located under and attached to frame 60. Linkage 82 is independently shown in figure 11, but can be seen also in figures 8-10. More particularly, linkage 82 comprises four elbowed L-shaped links 84, 86, 88, 90 which are each pivotable at their respective elbows 84a, 86a, 88a, 90a and which are pivotally linked by pairs with short rods 92, 94 centrally under frame 60, i.e. rear links 88, 90 are pivotally attached to rear rod 94, and front links 84, 86 are pivotally attached to front rod 92. Rods 92, 94 are in turn centrally integrally attached to the end portions of intermediate plates 96, 98 at 100, 102, with pivots 100, 102 being pivotally mounted to the frame 60 (not shown in figure 10). Thus, rod 92 and plate 96 are forced into integral pivotal displacement about pivot 100, as are rod 94 and plate 98 about pivot 102. Intermediate plates 96, 98 are pivotally attached to the two opposite ends of a T-shaped plate 104, which is in turn pivotally attached to the outer extremity of the movable rod 106 of a hydraulic cylinder 108 fixedly attached at its base to frame 60 at 110. Links 84, 86, 88, 90 are each pivotally attached to the carriage main frame 60 at 84b, 86b, 88b, 90b, and support horizontally disposed idle guide wheels 112, 114, 116, 118 at their outer free ends.

Thus, due to the interconnection of the different links, bars and rods of linkage 82, and to the fact that linkage 82 is only pivotally attached to frame 60 at 84b, 86b, 88b, 90b, at 100, 102 and at 110, guide wheels 112, 114, 116, 118 are integrally linked in their movements by linkage 82, i.e. if one wheel such as wheel 112 is force inwardly, then all other wheels 114, 116, 118 will also be forced to pivot inwardly of a same distance. Guide wheels 112, 114, 116, 118 thus pivot in a common symmetrical motion, relative to frame 60, from an outer limit position to an inner limit position. Hydraulic cylinder 108 continuously biases wheels 112, 114, 116, 118, by means of linkage 82, towards said outer limit position.

Wheels of a same side, i.e. wheels 112 and 118 and wheels 114 and 116, are longitudinally aligned, and each pair of longitudinally aligned wheels 112, 118 and 114, 116 laterally protrudes beyond all other structural elements of carriage 58, even when wheels 112, 114, 116, 118 are pivoted into their inner limit position, so as to engage against objects outboard of the carriage 58.

In use, to load palletized articles 36 into a semi-trailer 30, bogie 40 is moved along rails 38 towards loading station 20 as shown in figure 1, until it becomes aligned in facing register and centered with dock 22 as shown in figure 2. Automated cue means then trigger the controls of bogie 40 to immobilize it at this position, bogie 40 then also being in facing register with articles 36 since the latter, as stated hereinabove, are centrally aligned relative to bogie 40 by conveyor 34. The bogie gates 46, 48 are then pivoted towards their opened condition as also shown in figure 2, until they abut against the side walls of the semi-trailer 30 with their tips 46a, 48a. Gates 46, 48, in their opened condition, are then co-extensive and approximately collinear with the railings 50, 52, so as to define a carriage path from bogie 40 to semi-trailer 30.

The rear opening of semi-trailer 30 has been positioned in approximate facing register with dock 22 by a truck driver, but slight positional deviations of semi-trailer 30 relative to dock 22 can and in practice do occur. Indeed, it is likely that the semi-trailer 30 may not be exactly perpendicular to the dock opening 24 and/or not exactly centered relative to the dock opening 24, and thus a slight angular deviation of gates 46, 48 in their opened condition relative

to railings 50, 52 is possible, since the gates' outer free tips 46a, 48a abut against the misaligned semi-trailer opening. Also, depending on the width of the semi-trailer 30 opening, gates 46, 48 may be disposed in a parallel or in a more or less convergent or divergent fashion. However, railing 50 forms a continuous gate member with gate 48, as does railing 52 with gate 46, albeit not necessarily a straight one, which results in the "substantially" collinear relationship.

Once gates 46, 48 are in their opened condition, detection devices on bogie 40 measure the angles of gates 46, 48, and by simple trigonometric calculations based on the respective angles of gates 46, 48 which abut with their tips 46a, 48a against the semi-trailer 30 rear opening, or simply through an evaluation of the relative angles of gates 46, 48, bogie 40 moves so as to center itself relative to the semi-trailer 30 rear opening. Conveyor 34 then also moves consequently to align palletized articles 36 with the corrected position of bogie 40 by means of electronic cue means. Bogie 40 then becomes centered relative to the loading area opening, namely the semi-trailer 30.

The fork member 72 of forklift carriage 58 is then raised, as shown in figure 3, and carriage 58 moved forward as shown in figure 4 so that fork member 72 engage in a known manner the pallets 37a of palletized articles 36 located on overhead conveyor 34. Since palletized articles 36 are symmetrically aligned relative to bogie 40, articles are thus loaded on fork member 72 in a centered manner. As shown in figure 5, articles 36 are then retrieved by carriage 58 which moves rearwardly and then lowers its fork member 72. Carriage 58 finally moves forward into semi-trailer 30 as shown in figure 6 to unload the articles 36 therein. As shown in the drawings, the height of conveyor 34 is greater than that of dock opening 24, and thus the articles 36, destined to fit into a semi-trailer 30 and thus to also fit through dock opening 24, will vertically fit under conveyor 34.

According to the invention, the spring-loaded alignment linkage 82 allows carriage 58 to self- align and remain centered while it moves forward and backward between the railings 50, 52, the gates 46, 48 and the semi-trailer side walls. Indeed, the carriage guide wheels 112, 114, 116, 118 are continuously forced outwardly under the bias of hydraulic cylinder 108,

continuously center carriage 58 relative to the outboard surfaces that they bear against due to linkage 82, and continuously engage in their initial position the railings 50, 52 of bogie 40. When carriage 58 moves forward towards semi-trailer 30, guide wheels 112, 114, 116, 118 will continuously engage successively the railings 50, 52, the gates 46, 48 and the inner side walls of the semi-trailer 30. The force exerted by hydraulic cylinder 108 will force guide wheels 112, 114, 116, 118 to remain in abutment against the outboard surfaces as carriage 58 advances, and the linkage 82 will effectively center the carriage 58 during its path towards and into the semi-trailer 30.

Consequently, even if the semi-trailer is not perfectly centered or angularly oriented relative to the dock 22, the guide wheels 112, 114, 116, 118 in combination with the spring-loaded linkage 82, will ensure that carriage 58 enters the semi-trailer 30 in a correctly aligned and centered fashion. This is why carriage 58 is said to be self-aligning and self-centering.

It can be seen that the system according to the present invention can be used with semi-trailer trucks 30 of different widths. Indeed, if the semi-trailer is narrower, then the gates 46, 48 will abut against the semi-trailer side walls in a slightly convergent fashion, with the spring-loaded linkage 82 and the idle guide wheels 112, 114, 116, 118 compensating for the narrower path along which carriage 58 must advance by being contracted by the converging gates.

In one embodiment, the lateral offset between the pairs of longitudinally aligned wheels at the wheels outer limit position will be equal to or wider than the wider dimensions of semi-trailer trucks, and the angular deflections of linkage 82 will allow the pairs of longitudinally aligned wheels 112, 118 and 114, 116 to become at least as narrow as the narrower dimensions of semi-trailer trucks. For example, in North America, the width of conventional semi-trailers varies between approximately 94 inches (240 centimeters) and 102 inches (260 centimeters). Thus, the angular deflection of guide wheels 112, 114, 116, 118 would allow the width of the longitudinally aligned pairs of guide wheels 112, 118 and 114, 116 to vary at least between the

above-mentioned dimensions, so that carriage 58 would operatively fit into semi-trailers of all conventional dimensions. Of course, dimensional adjustments may be envisioned on linkage 82, to fit trucks of varying sizes, the above dimensions being provided as examples.

It is noted that with the system according to the present invention, loading of articles into semi-trailer 30 may be accomplished automatically, without any human intervention, after the operation is initiated. Indeed, the following sequential steps are automatically accomplished by the system according to the present invention:

a) initial positioning of bogie 40 in centered relationship with dock opening 24;

b) opening of gates 46, 48 until they abut against the semi-trailer 30 rear opening;

c) positional rectification of bogie 40 for centered alignment with the semi-trailer 30 storage area to reach a symmetrical angular relationship of gates 46, 48;

d) articles 36 are conveyed by conveyor 34 until they come in centered alignement with bogie 40 in its corrected position;

e) loading of palletized articles 36 onto carriage 58;

f) unloading of articles 36 from carriage 58 into the semi-trailer 30 storage area by carriage 58; and

g) return of carriage 58 to bogie 40;

where steps (d) to (g) may be repeated a number of times to load numerous palletized articles into semi-trailer 30, with the orientation of bogie 40 being corrected accordingly, if semi-trailer 30 is angularly offset relative to the loading station 22, by the action of the idle wheels 112, 114, 116, 118 and of linkage 82. The control units for controlling the displacements and movements of bogie 40, carriage 58 and conveyor 34 can be located in control panels 44 and 81.

Any further modification to the present invention, which does not deviate from the scope thereof, is considered to be included therein.

For example, it could be envisioned to provide a system according to the present invention which would comprise a single loading station, and consequently in which the transversely moving bogie would not be required.

Also, it could be envisioned to provide a system according to the invention lacking the carriage-guiding railings 50, 52 and pivotable gates 46, 48, in which the carriage 58 is initially aligned with the truck semi-trailer opening by other means, and then moved forward into the semi-trailer opening repetitively to successively load a number of articles. However, this is not the preferred way to carry out the invention.

Also, other article-carrying devices than forklift members could be used.

The hydraulic cylinder 108 used to force idle guide wheels 112, 114, 116, 118 towards their outer limit position, could be replaced by any suitable biasing member.

The guide wheels shown could be replaced with suitable guide members such as sliding elements, e.g. small skis made of a sliding material such as nylon.

It is understood that with the system according to the present invention for selectively moving articles into and out of a number of loading areas, the carriage has the capability of full longitudinal movement throughout the loading areas. That is to say, the carriage can move the whole length of each semi-trailer (if such is the loading area), without being hindered by other portions of the system. This is important since it allows the loading areas to be optimally loaded with articles.

Also, the carriage is movable along a continuous range of variable lateral distances in the lateral direction due to the bogie. This is advantageous since it allows the carriage to retrieve or load articles at intermediate positions between semi-trailer bays, if need be.

Also, the method according to the present invention can also be described as a method for moving an article from an initial position to a final position, with a selected one of said initial and final positions being within a loading area having an estimated position and a real position which may be laterally offset relative to said estimated position, with a system having mutually transversal longitudinal and lateral axes defining longitudinal and lateral directions, respectively, said system comprising a carriage comprising a powered article-carrying device and a bogie capable of carrying said carriage and having a pair of pivotable gates defining outer free

ends, said method comprising the steps of:

a) moving said bogie carrying said carriage along said lateral direction to a carriage lateral position longitudinally aligned with said loading area estimated position;

b) opening said bogie gates until at least one of said gates abuts against a reaction surface corresponding to said loading area real position;

c) rectifying the position of said bogie along said lateral direction according to the respective angular positions of said gates, for longitudinally aligning said bogie with said loading area real position;

d) moving said carriage along said longitudinal direction towards said article initial position to a carriage longitudinal position determined by said article initial position;

e) retrieving said article with said article-carrying device;

f) moving said carriage along said longitudinal direction towards said article final position to a carriage longitudinal position determined by said article final position; and

g) depositing said article in said final position with said article-carrying device.

It is understood that according to a preferred way to carry out the above-defined method of the invention, in step (b), the bogie gates are opened until both gates abut against respective reaction surfaces corresponding to said loading area real position.

Reference to reaction surfaces is made hereinabove, since it will be obvious to someone skilled in the art of the present invention that the lateral walls of the semi-trailer are not the only stoppers that can be used for abutment of the bogie gates. Indeed, other reaction surfaces such as upright posts provided on a truck bed may also be used.

It is understood that the above-described system according to the present invention, could use a different suitable article-handling assembly than a conveyor, for moving articles to be loaded in a semi-trailer towards the carriage, and to move articles unloaded from the semi-trailer away from the carriage.

More than one carriage may be used in a system according to the present invention, which is naturally likely to increase the production capacity of the system.